

## **REMARKS**

Claims 1-7, 9-35, 39-43, and 45-53 are pending in the application with claims 1, 2, 3, 18, 24, 26, 29, 30, 31, 34, and 41 amended herein, claims 8 and 36 cancelled herein, and claims 37, 38, and 44 previously cancelled.

Claims 1-23 and 34-53 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang (US Patent No. 6,878,402). Claims 24-33 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang. Applicant requests reconsideration.

Amended claim 1 sets forth a deposition method that includes, among other features, at a first temperature, contacting a substrate with a first precursor containing dichlorosilane, altering the first temperature by removing heat with a thermoelectric heat pump thermally connected to the substrate to establish a second temperature, and, at the second temperature lower than the first temperature, contacting a chemisorbed first layer with a second precursor containing ammonia. The method includes reacting a chemisorbed second layer with the first layer and forming a  $\text{Si}_3\text{N}_4$  layer. Amended claim 1 thus incorporates the subject matter of previous claims 3 and 8 along with other limitations supported at least by paragraph 41 of the present specification. Applicant asserts that Chiang fails to disclose or suggest every limitation of amended claim 1.

Review of Chiang (US Patent No. 6,878,402) does not reveal disclosure of a first precursor containing dichlorosilane or of a second precursor containing ammonia.

Also, review of Chiang reveals an express teaching against altering the first temperature to establish a second temperature lower than the first temperature at least in column 6, lines 18-24 and column 7, lines 39-44. Only the Applicant's own specification, at least in paragraphs 29 and 32, teaches a lower second temperature to avoid desorbing the first precursor while contacting the first layer with a second precursor. Notably, Chiang focuses upon the exact opposite of the claimed deposition conditions.

Page 2 of the Office Action implies that it would be obvious to use the claimed thermoelectric heat pump under an alleged motivation "to improve the uniformity of the heat across the wafer increasing the evenness of the deposition." However, review of Chiang, the only cited reference, does not reveal any teaching that a thermoelectric heat pump improves the uniformity of heat. Accordingly, the alleged motivation does not in any way prompt a person of ordinary skill to use a thermoelectric heat pump since no support exists for the proposition that such a device improves the uniformity of heat. Instead, a thermoelectric heat pump provides other advantages discussed herein and supported by the present specification and such advantages are not suggested in the prior art. The alleged motivation to modify Chiang is thus invalid.

At least for such reasons, Applicant asserts that Chiang fails to disclose or suggest every limitation of amended claim 1. Claims 2-7 and 9-23 depend from claim 1 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

For example, amended claim 2 sets forth that the reacting in claim 2 includes heating the first layer and the second layer to a third temperature higher than the second temperature and first temperature. At least paragraph 30 of the present specification supports the amendment to claim 2. Even though Chiang is alleged to disclose a third temperature, review of Chiang reveals that it fails to disclose or suggest a third temperature that is higher than both the second temperature and first temperature.

Also, for example, amended claim 3 sets forth that heating the first layer and the second layer to a third temperature in claim 2 includes adding heat with the thermoelectric heat pump. Page 3 of the Office Action acknowledges that Chiang fails to disclose a thermoelectric heat pump but alleges that it is "merely a design option" resulting from an obvious modification of Chiang. Applicant notes that at least column 6, lines 45-56 of Chiang recognize the increased complexity of the devices and methods described in Chiang, but fail to disclose any suggestion of devices suitable to reduce such complexity. As may be appreciated from paragraphs 31 and 40 of the present specification, the method of claim 3 produces similar advantages to those described in Chiang, but does so with a less complex method.

That is, Chiang relies upon a chilled ESC for cooling and separate and distinct devices for heating, as discussed in column 7, line 66 to column 8, line 12. Chiang fails to disclose or suggest any method such as set forth in claim 3 that includes using a single device capable of both removing heat

and adding heat, as set forth in claim 3. Thus, the method of claim 3 provides the advantage of simplifying the methods set forth in Chiang.

Amended claim 24 sets forth a deposition method that includes, among other features, ALD of a first specie over a substrate approximately at an optimum temperature for the first specie deposition and removing heat with a thermoelectric heat pump thermally connected to the substrate. The method includes ALD of a second specie on the first specie approximately at an optimum temperature for the second specie deposition lower than the first specie optimum temperature. The second specie is reacted with the first specie at an optimum temperature for the reaction greater than the second specie optimum temperature and the first specie optimum temperature. As may be appreciated from the discussion above regarding the deficiencies of Chiang as applied to claim 2, Chiang fails to disclose or suggest the claim 24 limitation of an optimum temperature for the reaction greater than the second specie optimum temperature and the first specie optimum temperature. At least for such reason, claim 24 is patentable over Chiang.

Claims 25-33 depend from claim 24 and are patentable at least for such reason as well as for the additional limitations of such claims not disclose or suggested. For example, claim 26 sets forth that the first specie is deposited from dichlorosilane, the second specie is deposited from ammonia, and the reacting produces  $\text{Si}_3\text{N}_4$ . Also, for example, claim 31 sets forth that the method of claim 24 further includes adding heat with the

thermoelectric heat pump to obtain the optimum temperature for the reaction. As may be appreciated from the discussion above regarding the deficiencies of Chiang as applied to claims 1 and 3, Chiang does not disclose or suggest every limitation of respective claims 26 and 31

Further, for example, amended claim 30 sets forth that the first specie of claim 24 is an initial specie and is the same as the second specie. At least paragraph 32 of the present specification supports the amendment to claim 30. Review of Chiang does not reveal disclosure or suggestion of the subject matter of amended claim 30.

Amended claim 34 sets forth a deposition method that includes, among other features, chemisorbing a first monolayer at a first temperature, removing heat with a device exhibiting a thermoelectric effect and establishing a second temperature lower than the first temperature, chemisorbing a monolayer of a second compound on the first monolayer of the first compound, adding heat with the device exhibiting a thermoelectric effect to re-establish the first temperature, and chemisorbing a second monolayer on the monolayer of the second compound. As may be appreciated from the discussion above regarding the deficiencies of Chiang as applied to claim 3, Chiang fails to disclose or suggest both removing heat and adding heat with a device exhibiting a thermoelectric effect. At least for such reason, Chiang fails to disclose or suggest every limitation of claim 34.

Claims 35 and 39-43 depend from claim 34 and are patentable at least for such reason as well as for the additional limitations of such claims not

disclosed or suggested. For example, claim 41 sets forth that the first monolayer is chemisorbed from dichlorosilane and the second monolayer is chemisorbed from ammonia.

Original claim 45 sets forth a deposition method that includes, among other features, chemisorbing a first monolayer of a first compound while maintaining a substrate at a first temperature with a heater, adding or removing heat with a device different from the heater and establishing the substrate at a second temperature different from the first temperature, and chemisorbing a monolayer of a second compound on the first monolayer at the second substrate temperature. The method includes adding heat to establish the substrate at a third temperature higher than the second temperature and reacting the chemisorbed second compound with the chemisorbed first compound, adding or removing heat to establish the substrate at approximately the first temperature, and chemisorbing a second monolayer of the first compound on the reacted layer of first and second compounds. Applicant notes that the third temperature is different from the first temperature since claim 45 sets forth "adding or removing heat" to establish the substrate at approximately the first temperature after reacting at the third temperature. Page 2-3 of the Office Action allege that Chiang discloses every limitation of claim 45 except for the heating means. Applicant traverses.

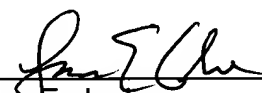
Review of Chiang does not reveal any disclosure or suggestion of a third temperature higher than the second temperature and used for reacting

chemisorbed compounds. Chiang does not appear to recognize that any advantage exists in chemisorbing compounds at certain different temperatures and then reacting the compounds at a still different temperature. Paragraph 30 of the present specification discusses the advantages of the method set forth in claim 45. Review of Chiang does not reveal any appreciation for the advantages of the methods set forth in claim 45. Accordingly, Applicant asserts that no motivation exists to modify Chiang and produce the method of claim 45. At least for such reason, claim 45 is patentable over Chiang. Claims 46-53 depend from claim 45 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested. For example, claim 46 sets forth that the device exhibits a thermoelectric effect. As established herein, Chiang fails to disclose or suggest the subject matter of claim 46.

Applicant herein establishes adequate reasons supporting patentability of claims 1-7, 9-35, 39-43, and 45-53 and requests allowance of all pending claims in the next Office Action.

Respectfully submitted,

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